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Voltammetric evaluation of the antioxidant capacity of tea on electrodes modified with multiwalled carbon nanotubes

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Abstract

The characteristics of the voltammograms of tea polyphenols on a glassy carbon electrode modified with multiwalled carbon nanotubes (MCNT-GCE) were evaluated. With the use of atomic force micros copy, it was found that MCNTs are oriented as rows 0.8-1.0 μm wide with alternating hills to 586 nm in height. Polyphenols other than of tannin are reversibly oxidized at the first step. Corresponding electrode reaction schemes are proposed. A voltammetric procedure for the estimation of the antioxidant capacity (AOC) of tea based on the oxidation of its polyphenol compounds was developed. The voltammograms of tea exhibited clearly defined peaks and oxidation steps whose potentials depend on the type of tea. The area of oxidation peaks was chosen as the parameter that characterizes antioxidant properties. The AOC of tea was expressed in terms of catechin equivalents per 100 mL of a beverage. 27 tea samples were analyzed. It was found that the AOC of green tea is 79% higher than that of black tea (290 ± 40 and 54 ± 22 mg/100 mL, respectively, $P < 0.05$). The AOC of oolong tea (70 ± 5 mg/100 mL) is considerably lower than that of green tea and statistically insignificantly higher than that of black tea. The AOC of white tea is comparable with the AOC of green tea (255 ± 11 and 290 ± 40 mg/100 mL, respectively, $P > 0.05$). © Pleiades Publishing, Ltd., 2013.

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Keywords

Antioxidant capacity, Carbon nanotubes, Cyclic voltammetry, Food analysis, Modified electrodes, Polyphenols, Tea